

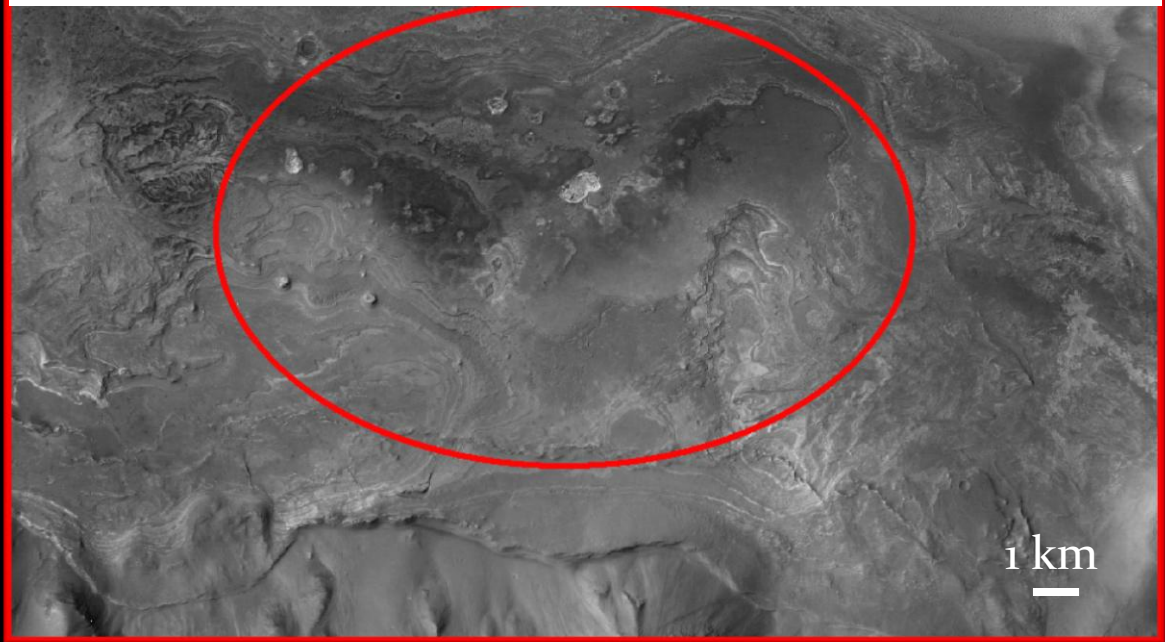
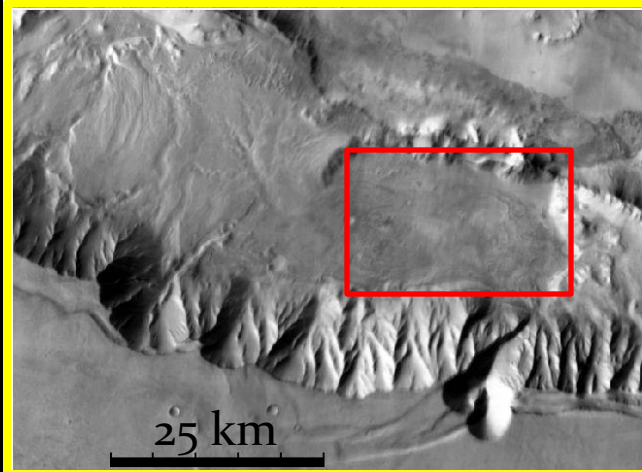
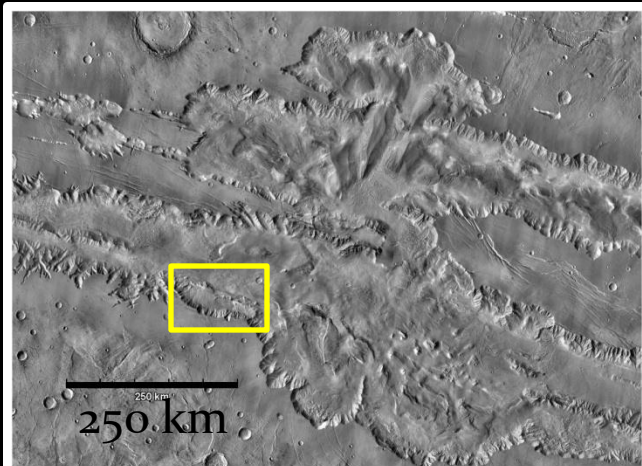
Future A 2018 Rover Mission to Aqueous Deposits in the Melas Chasma Basin

Rebecca M. E. Williams and Cathy M. Weitz



- Postulated paleolake site
- Candidate landing site for MER and MSL

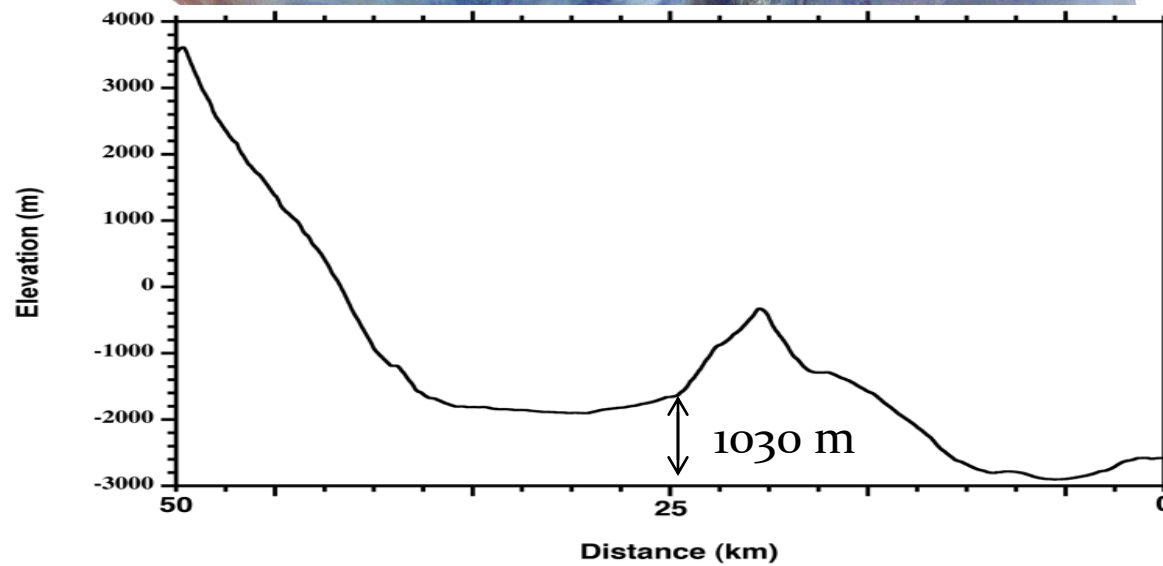
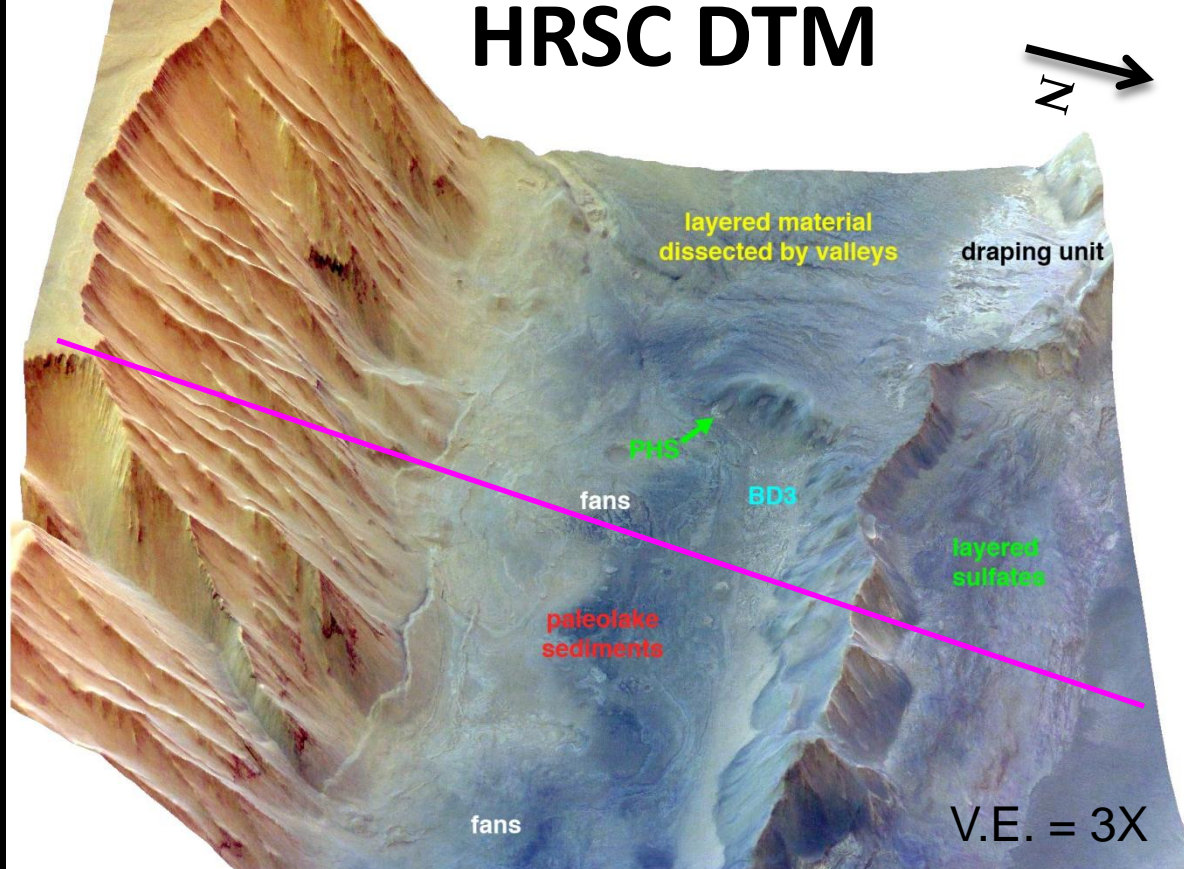
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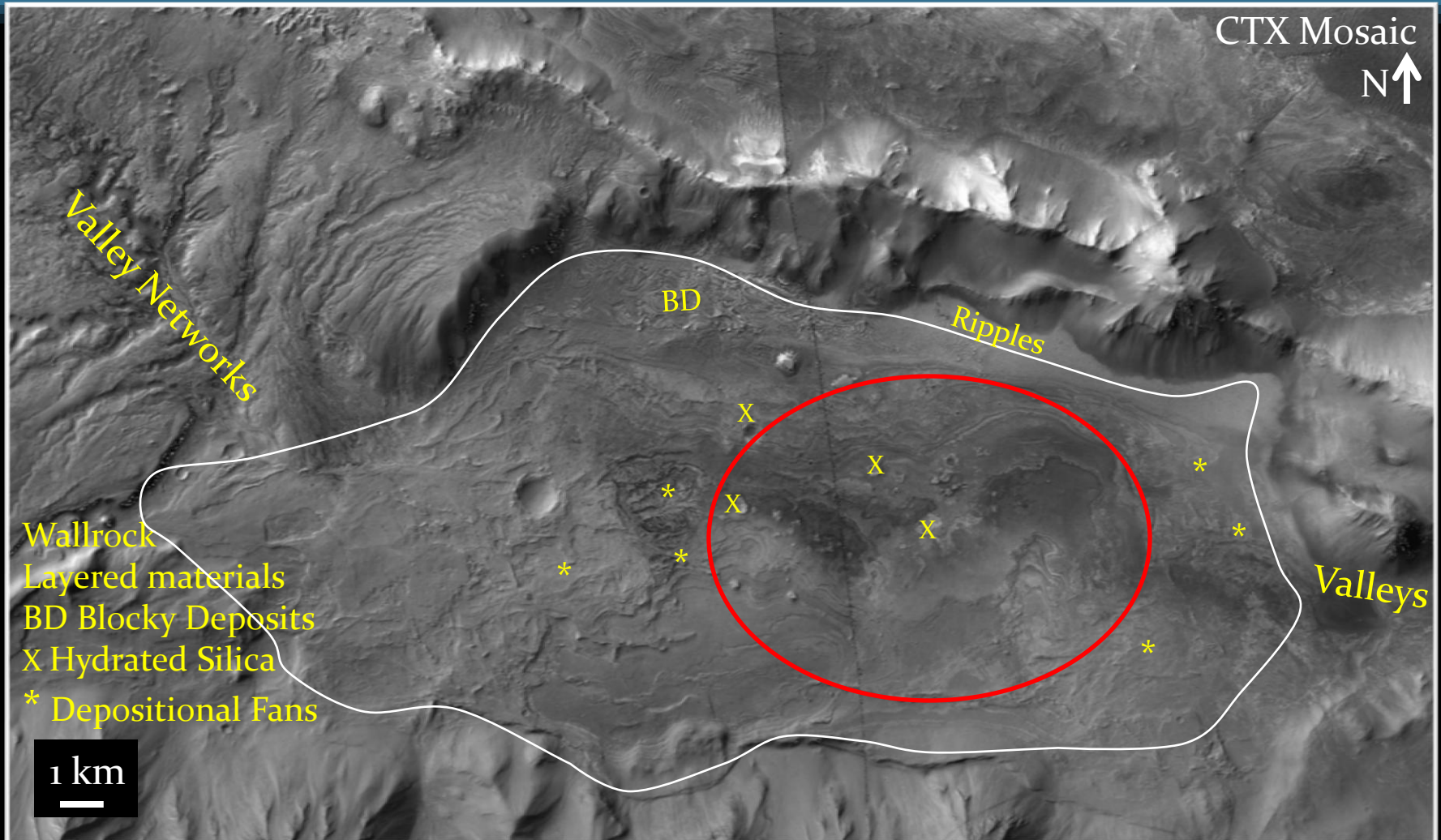
Rationale for *in situ* exploration in the Melas Basin Chasma

- Postulated Hesperian-aged paleolake (e.g., Quantin et al., 2005)
 - High preservation potential for organics → SG Assess evidence for life
- Diversity of geologic targets
 - SG Reconstruct history of surface processes and climate change
- Hypothesis testing of environmental conditions can be conducted by rover
 - SG Constrain atmospheric history
 - SG Reconstruct history of surface processes and climate change
 - SG Assess evidence for life
- New terrain contributes to our ground-based knowledge
SG → Assess potential hazards and resources for future human explorers.

HRSC DTM

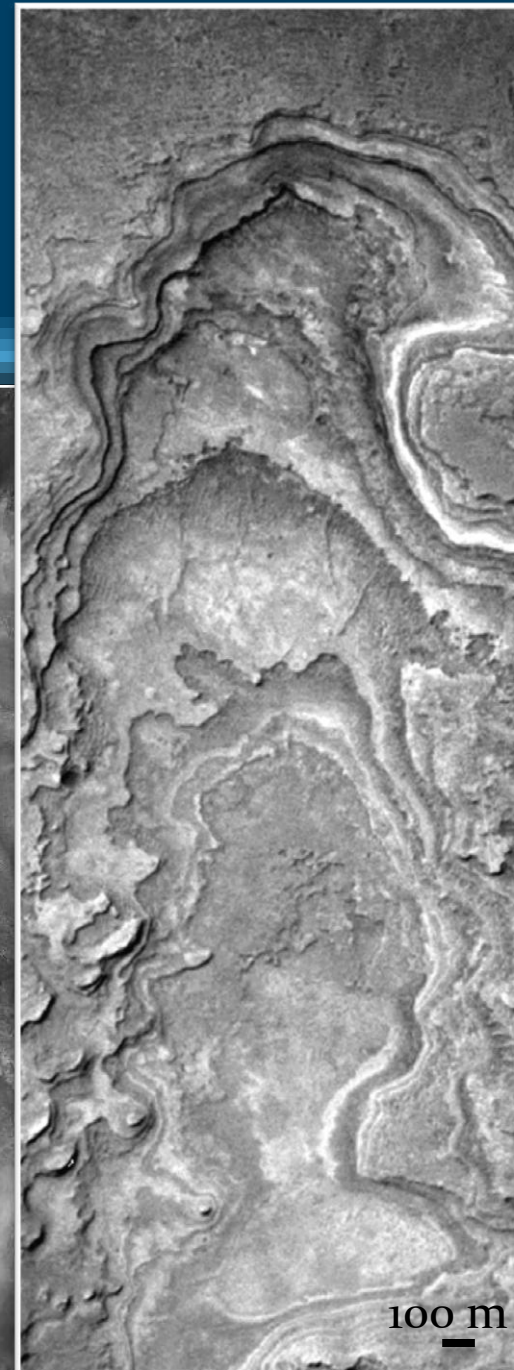
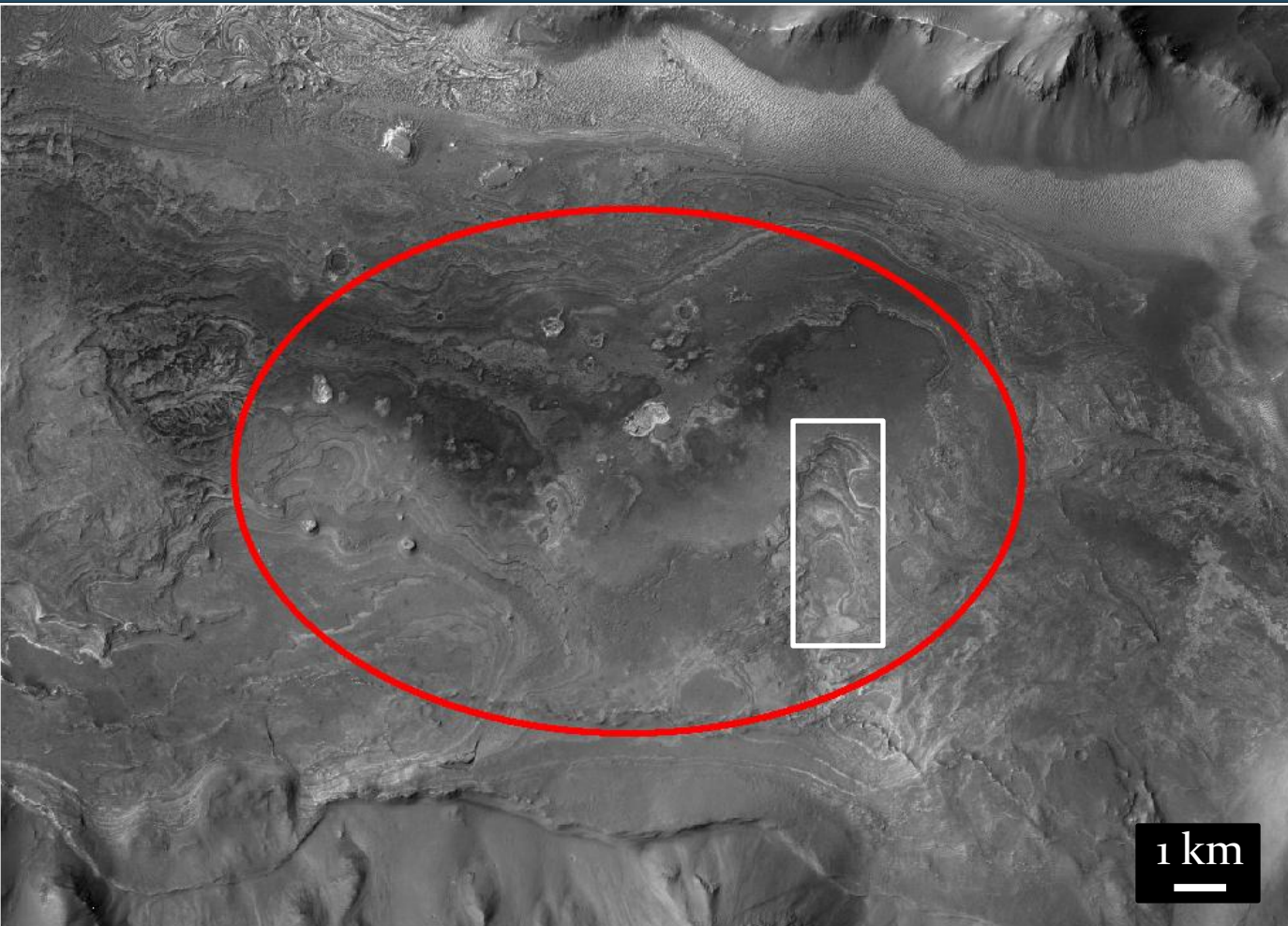


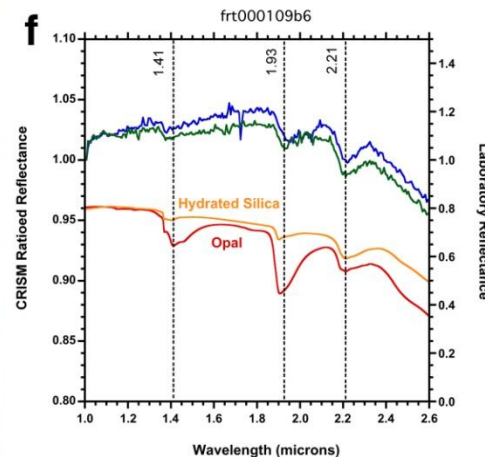
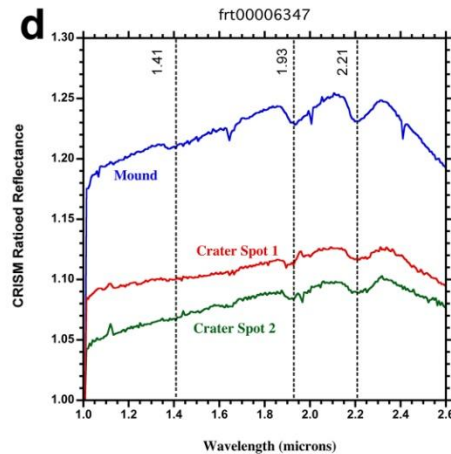
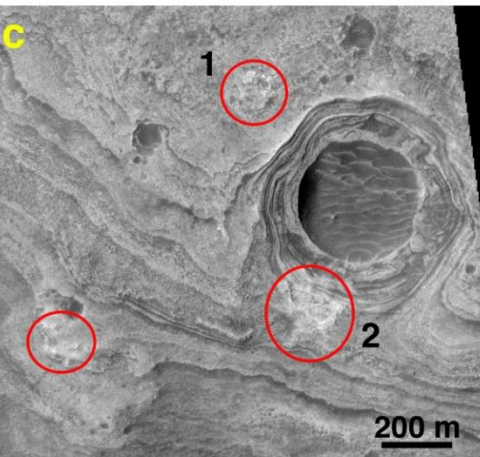
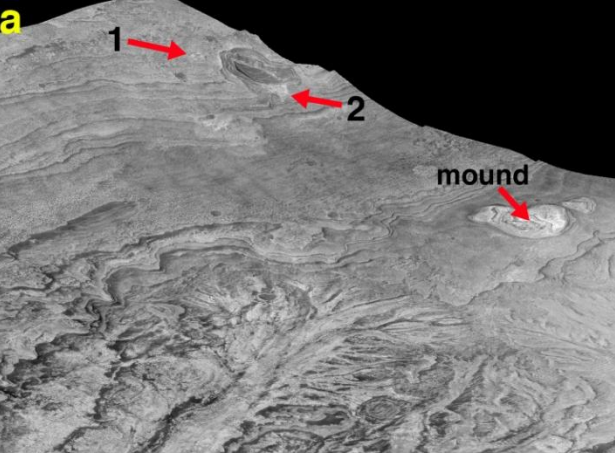
Multiple interesting geologic features in and adjacent to ellipse



Layered Materials

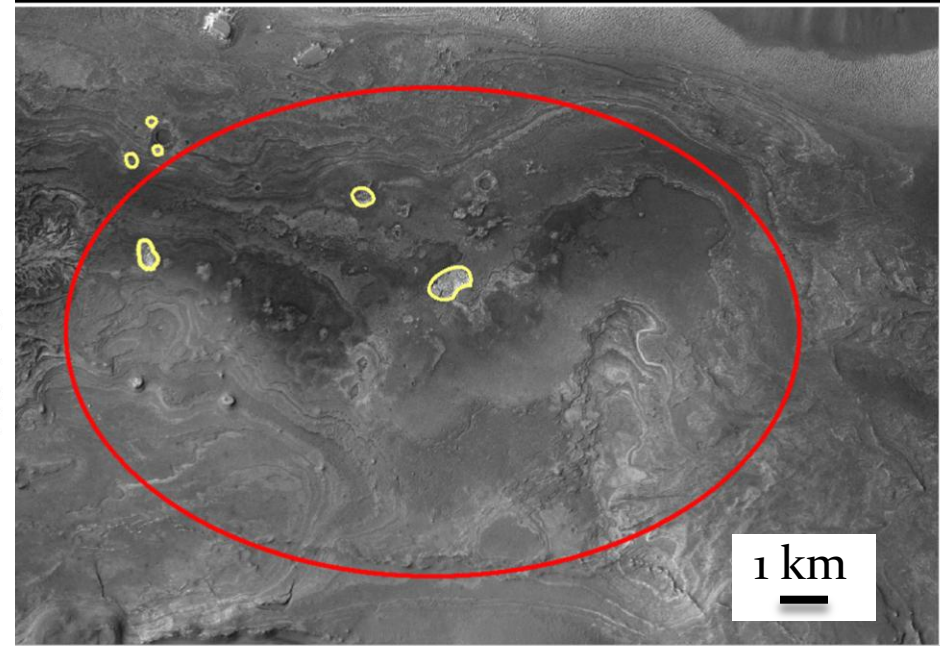
Hypotheses: lacustrine, aeolian, volcanic



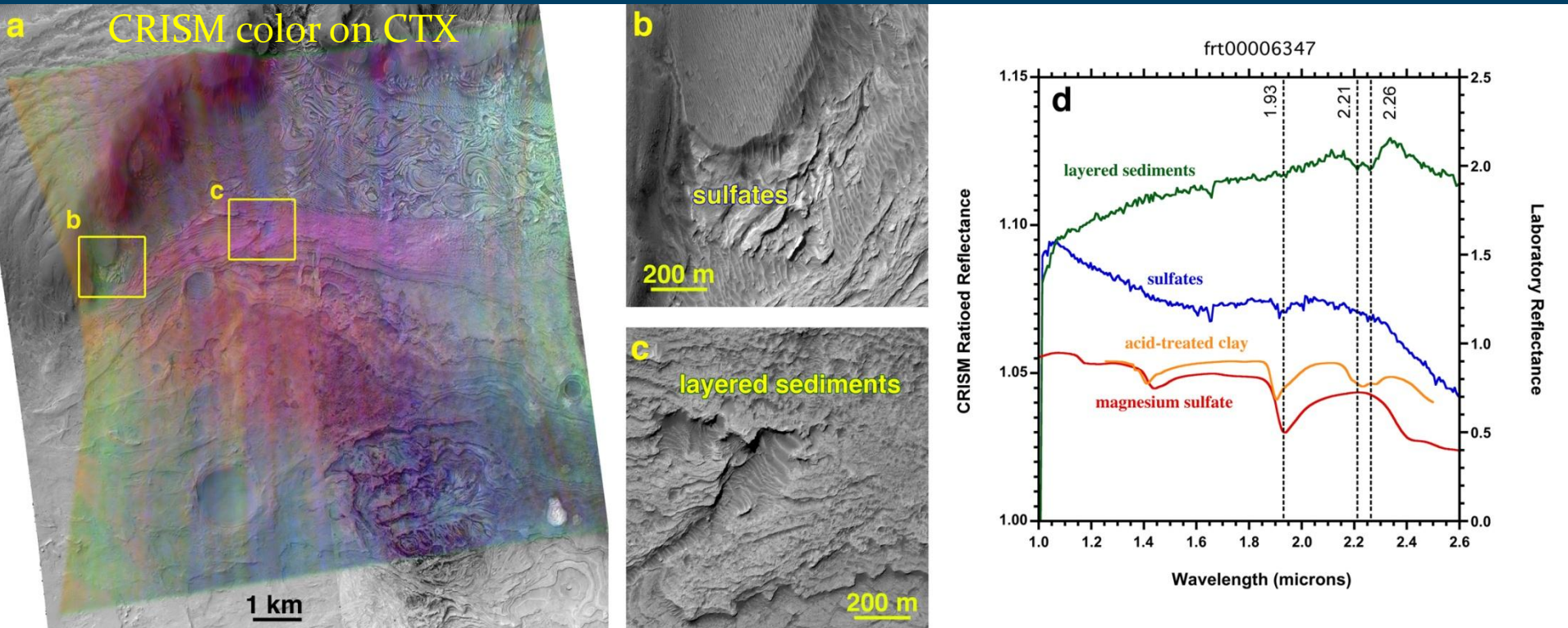


Hydrated Silica/Opal

- Associated with fresher, brighter exposures of pre-existing beds
- Not tied to one bed or elevation
- Alteration of sediments by unknown processes



Sulfates in the Melas Basin



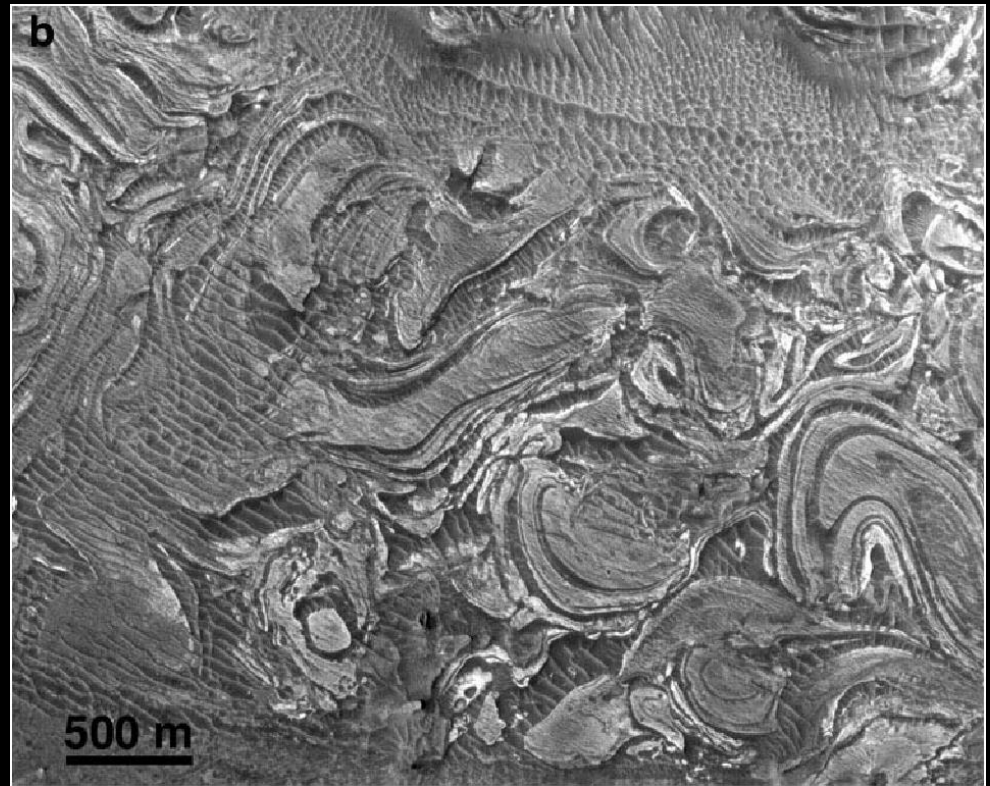
Layered sediments lack 1.9 μm hydration feature but have 2.21 and 2.26 doublet

Polyhydrated Sulfates (PHS) detected in small exposure at western edge of basin
--Nearby Blocky Deposit could be composed of same PHS

Blocky Deposits (BD)

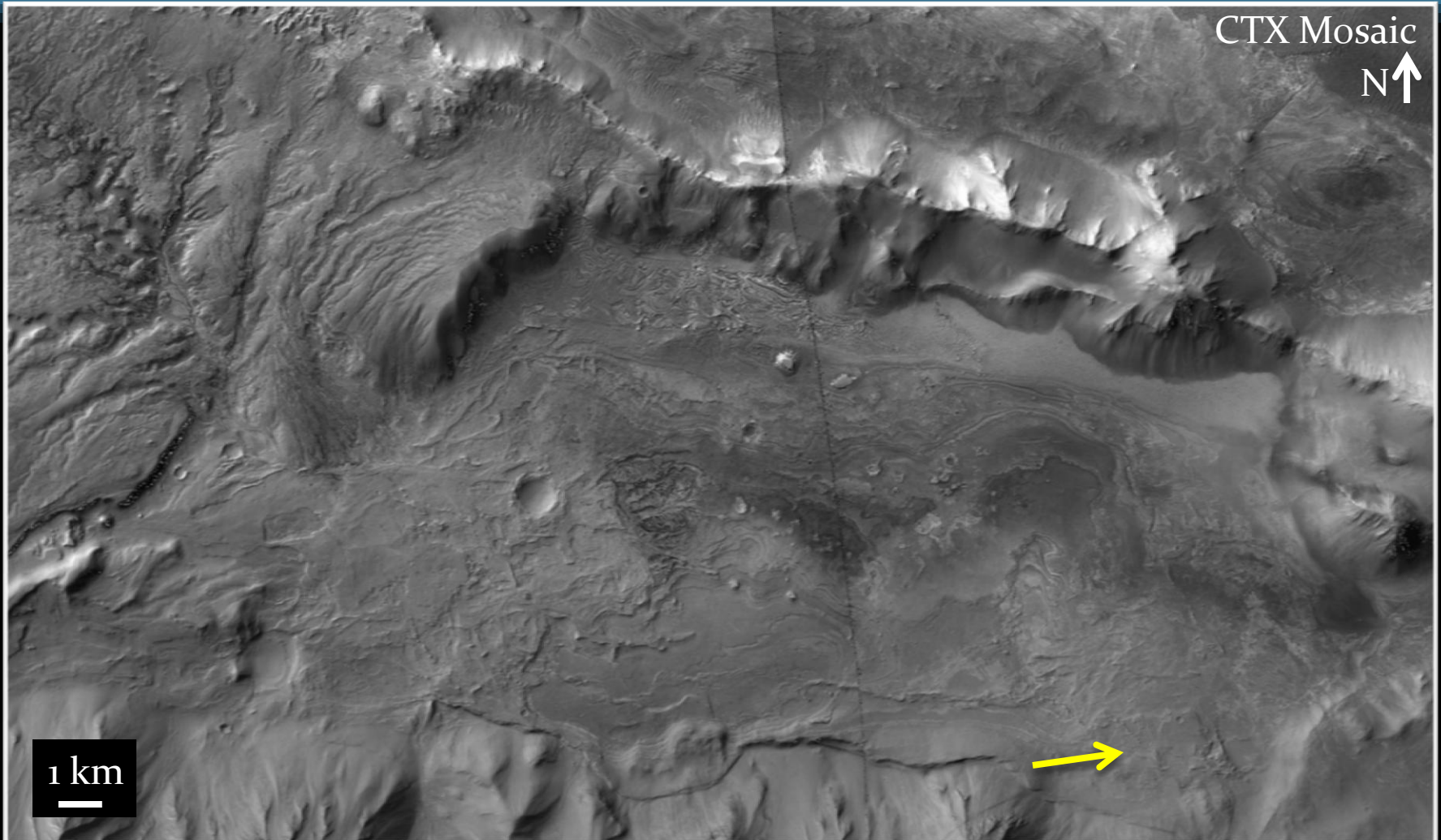
Hypothesis: Mass Wasting Material

- Bright, rounded blocks within darker matrix.
- Morphology suggestive of both brittle and ductile deformation
- Similar BD observed elsewhere in Valles Marineris

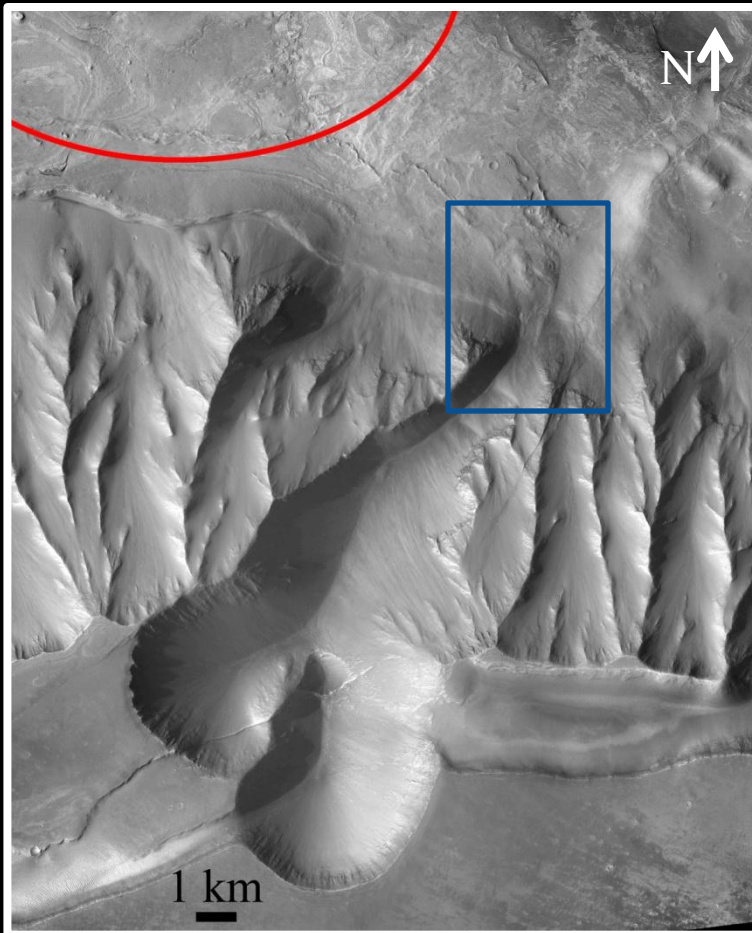


Fan Deposits

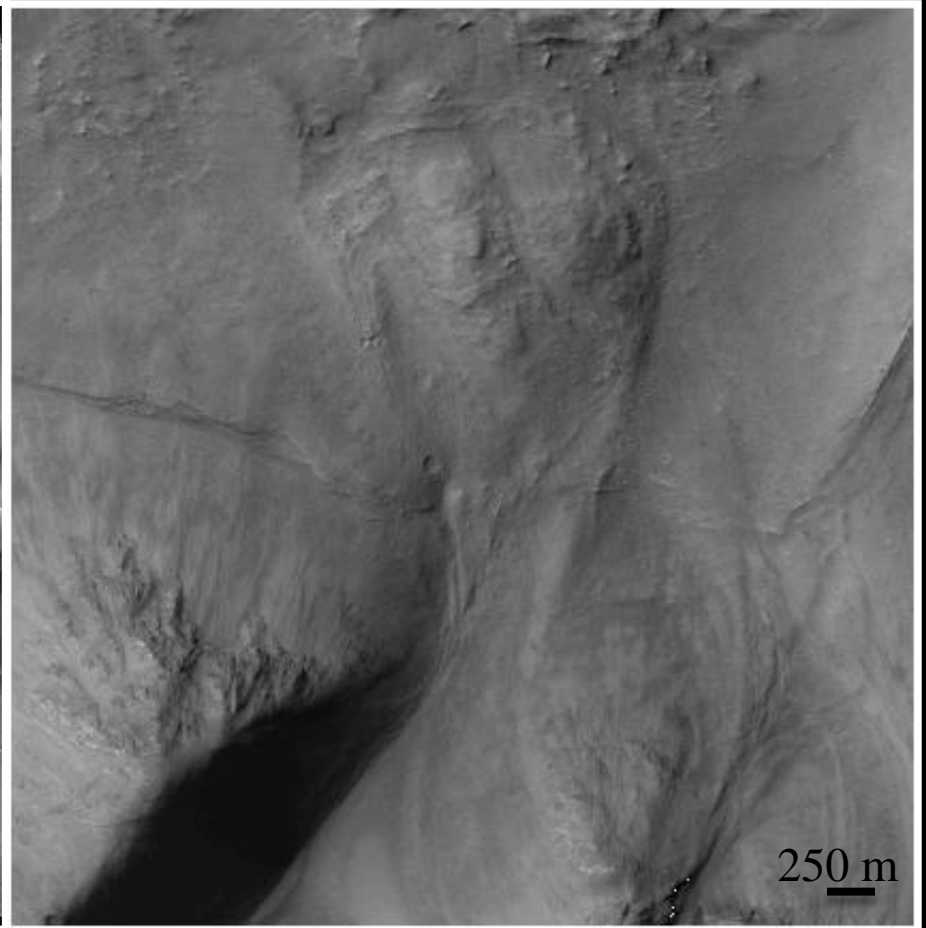
Hypotheses: Submarine fans, shallow deltas, alluvial fans, landslides



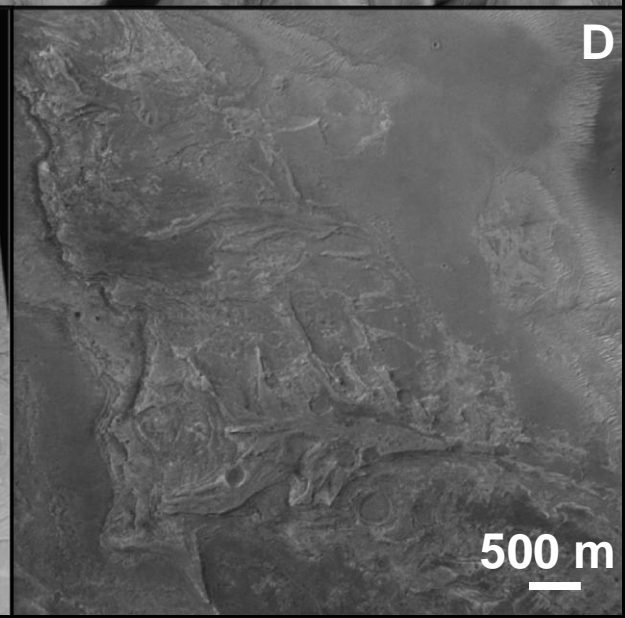
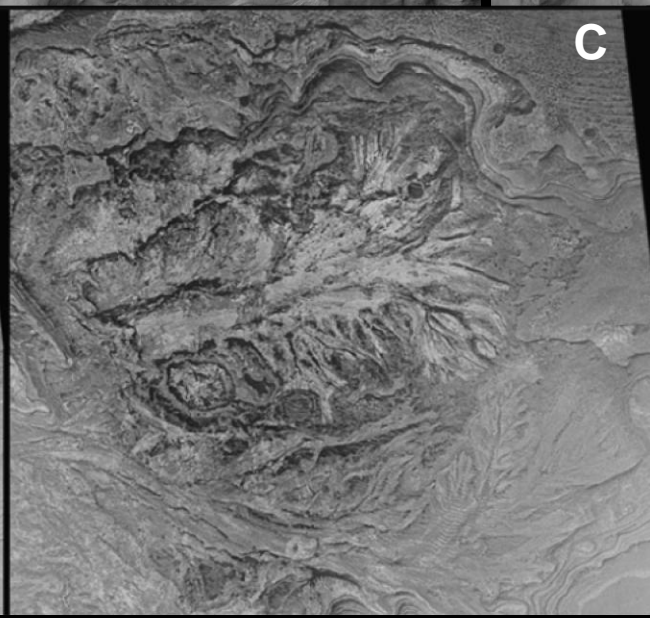
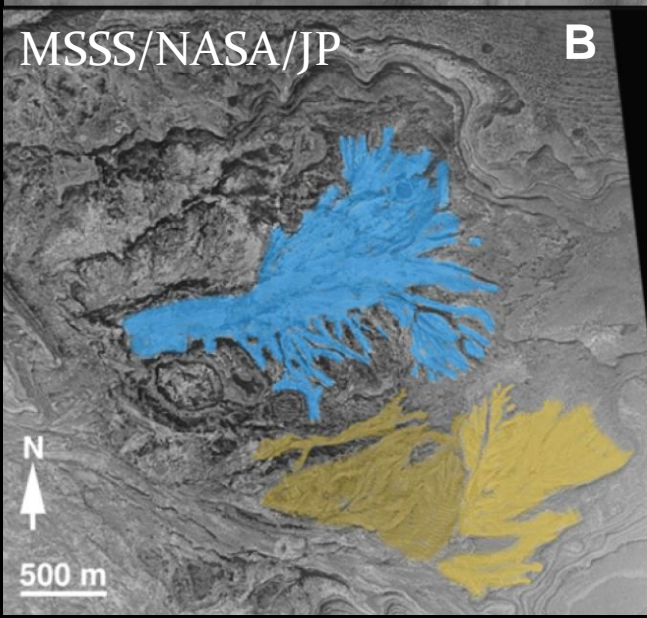
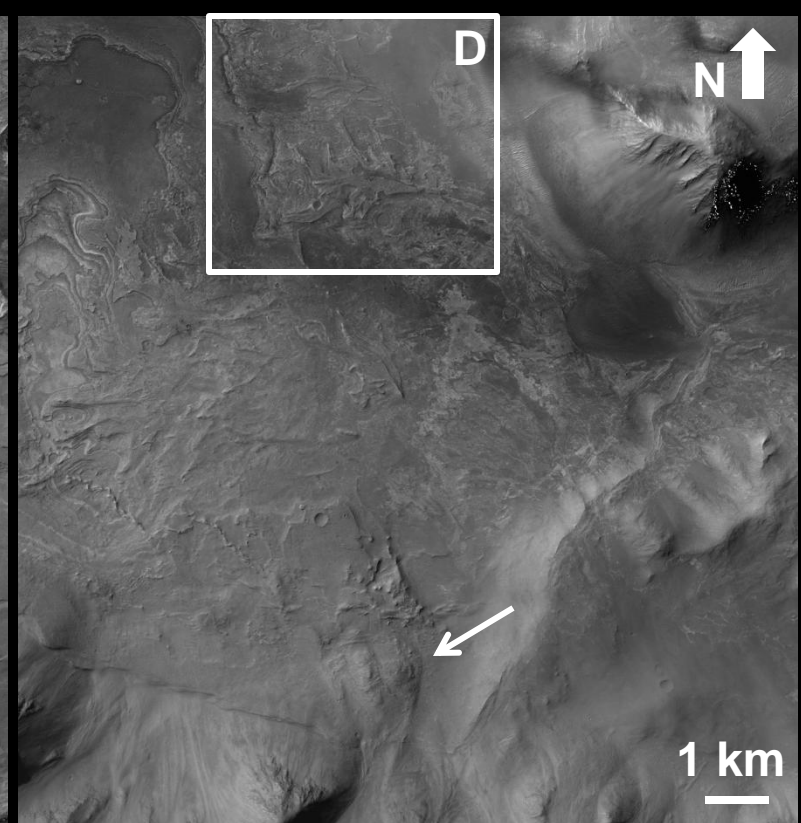
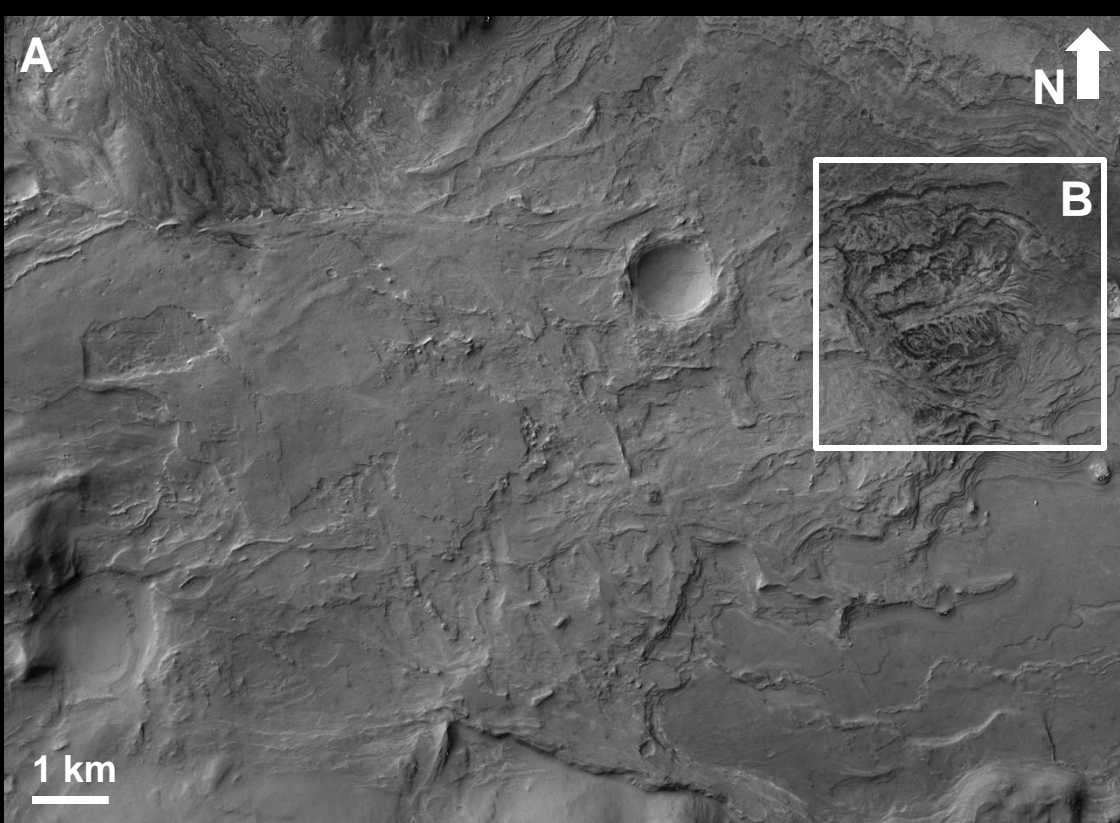
Fan Deposits



Bo5_011649_1701



Po5_002828_1711



Valley Networks

CTX

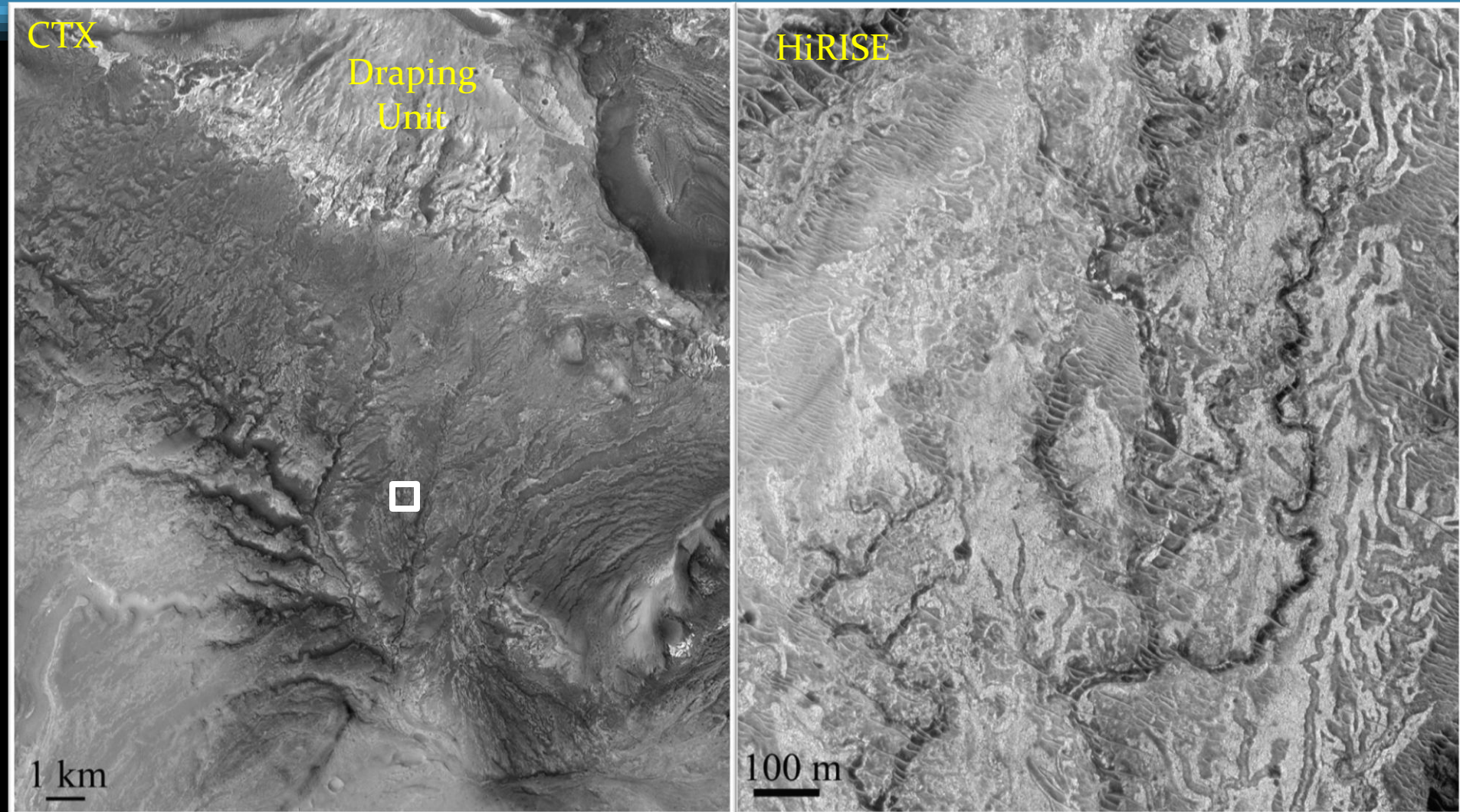
Draping
Unit



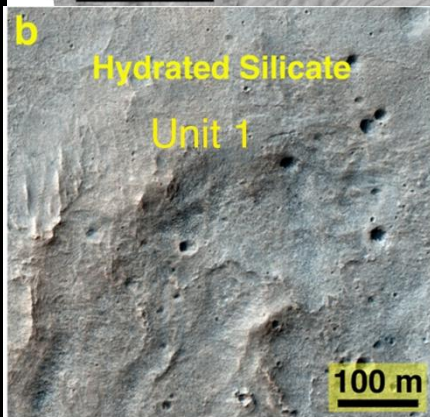
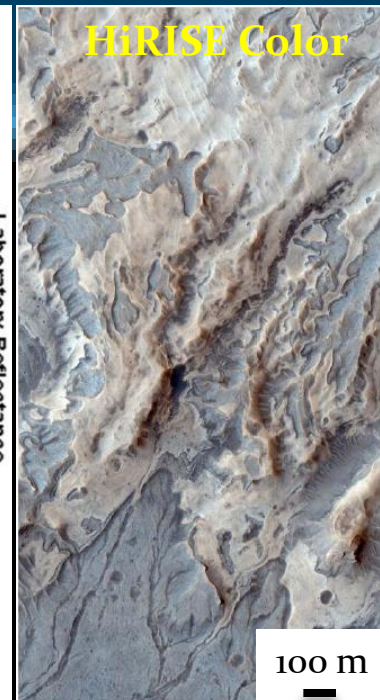
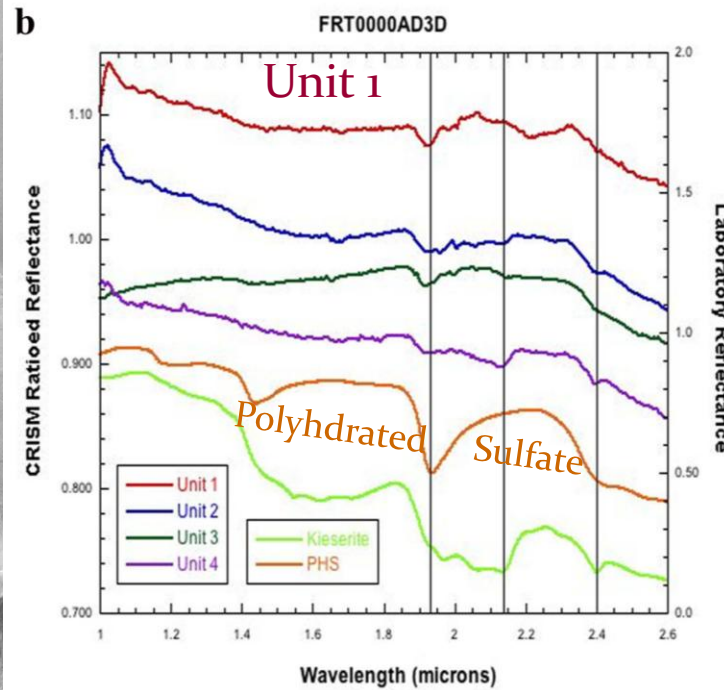
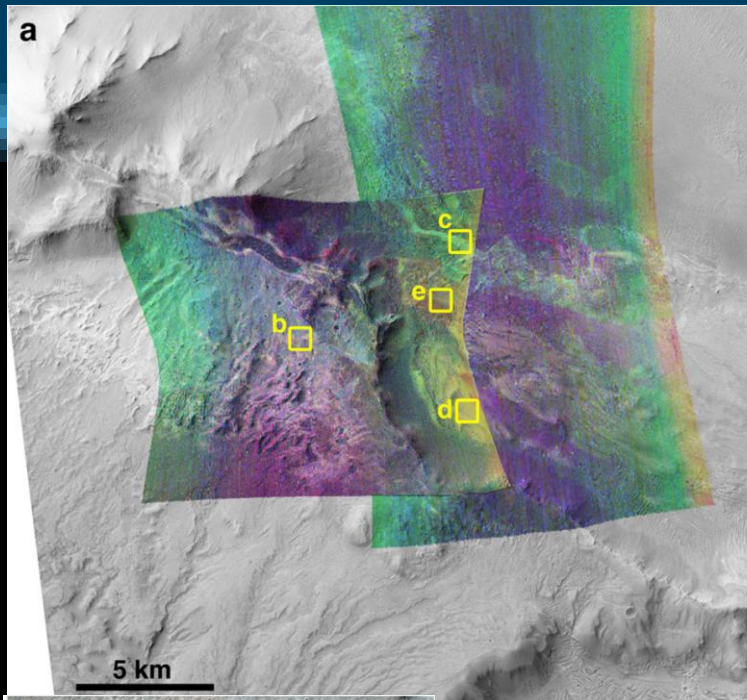
1 km

HiRISE

100 m



Draping Unit—Long term target

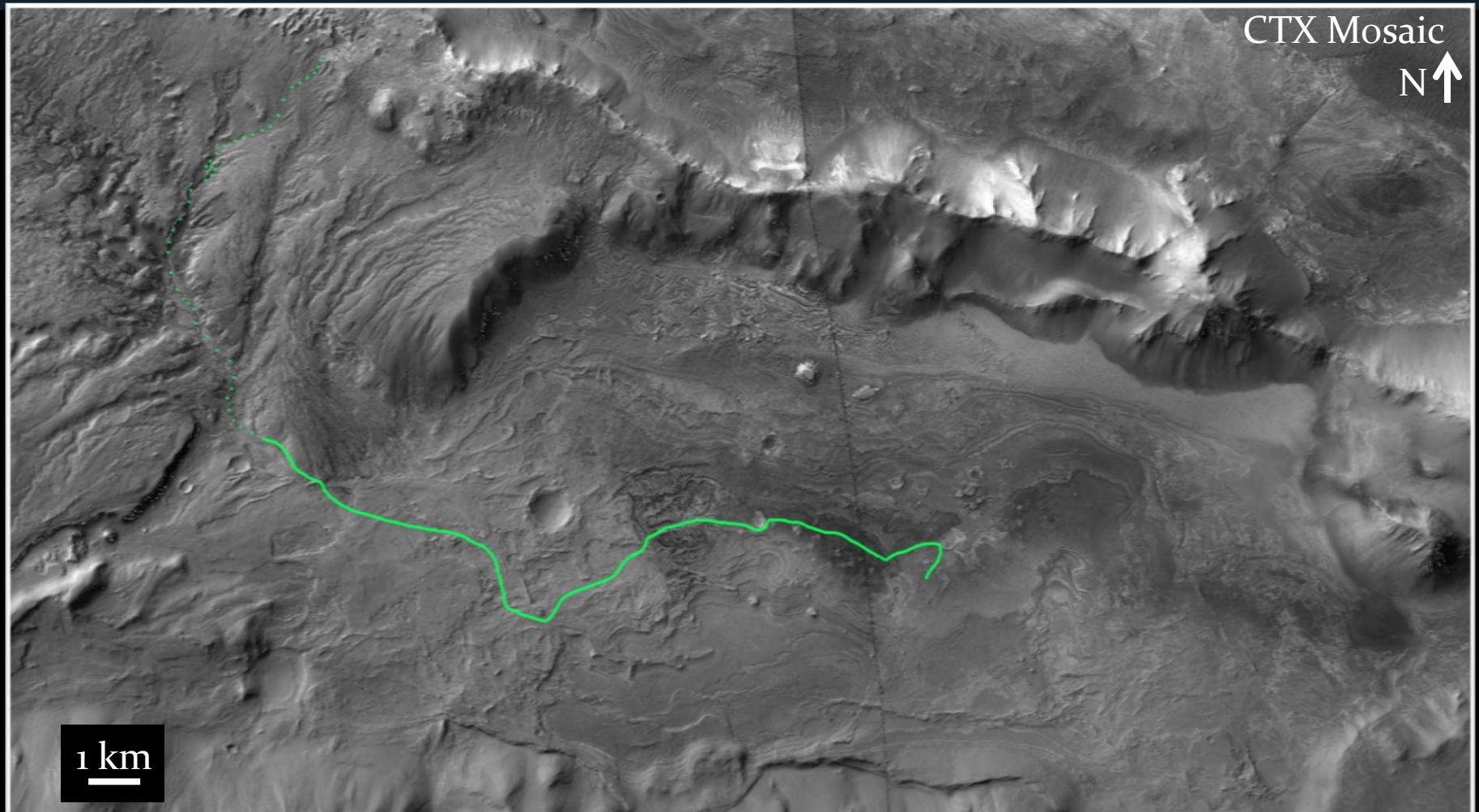


(Weitz et al., 2009, *LPSC*)

Light-toned unit upslope along wallrock, smooth at meter scale, ~10 m thick
Sulfates recognized in OMEGA (Gendrin et al., 2005, *Science*).

CRISM absorptions consistent with hydrated sulfate (e.g., epsomite) & hydrated silica. (Weitz et al., 2009, *LPSC*)

Potential Route



Engineering Constraints (Assuming MSL 'Sky Crane' EDL)

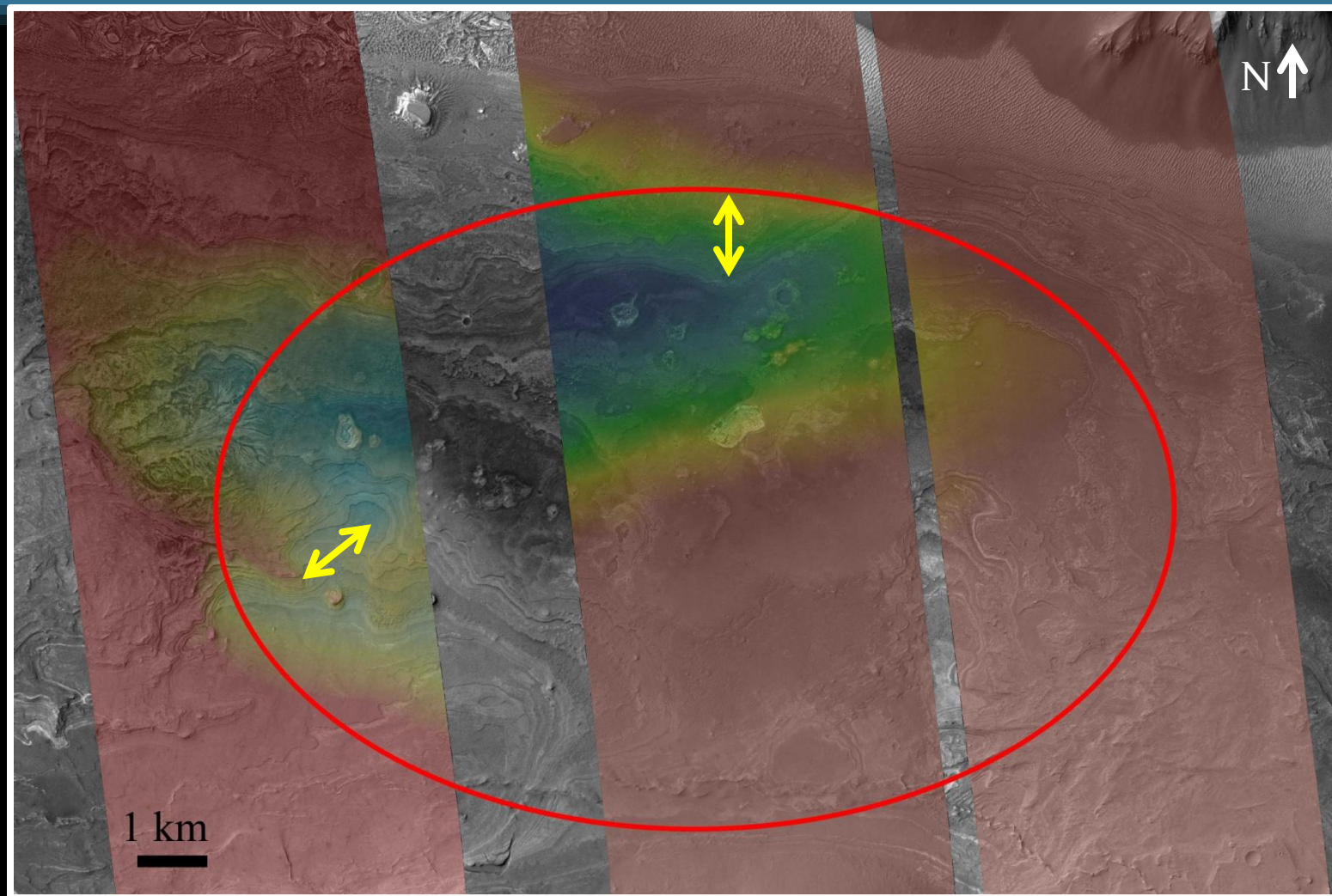
	Criteria	
Elevation	Below 0 km	✓
Latitude	Within 30° of the equator	✓
Slope	<20° over 2-10 km	✓
	<25° over 2-5 m	✓
Relief	<100 m over 1-1,000 m	X
Rocks	Probability of rock 0.55 m tall in area of 4 m ² is <0.5%	?
Thermal inertia	> 100 J m ⁻² s ^{-0.5} K ⁻¹	✓
Albedo	<0.25	✓

From "MSL Landing Site Selection User's
Guide to Engineering Constraints," 2007.

Relief Criteria <100 m relief over 1-1000 m

(to ensure proper control authority and fuel consumption during powered descent)

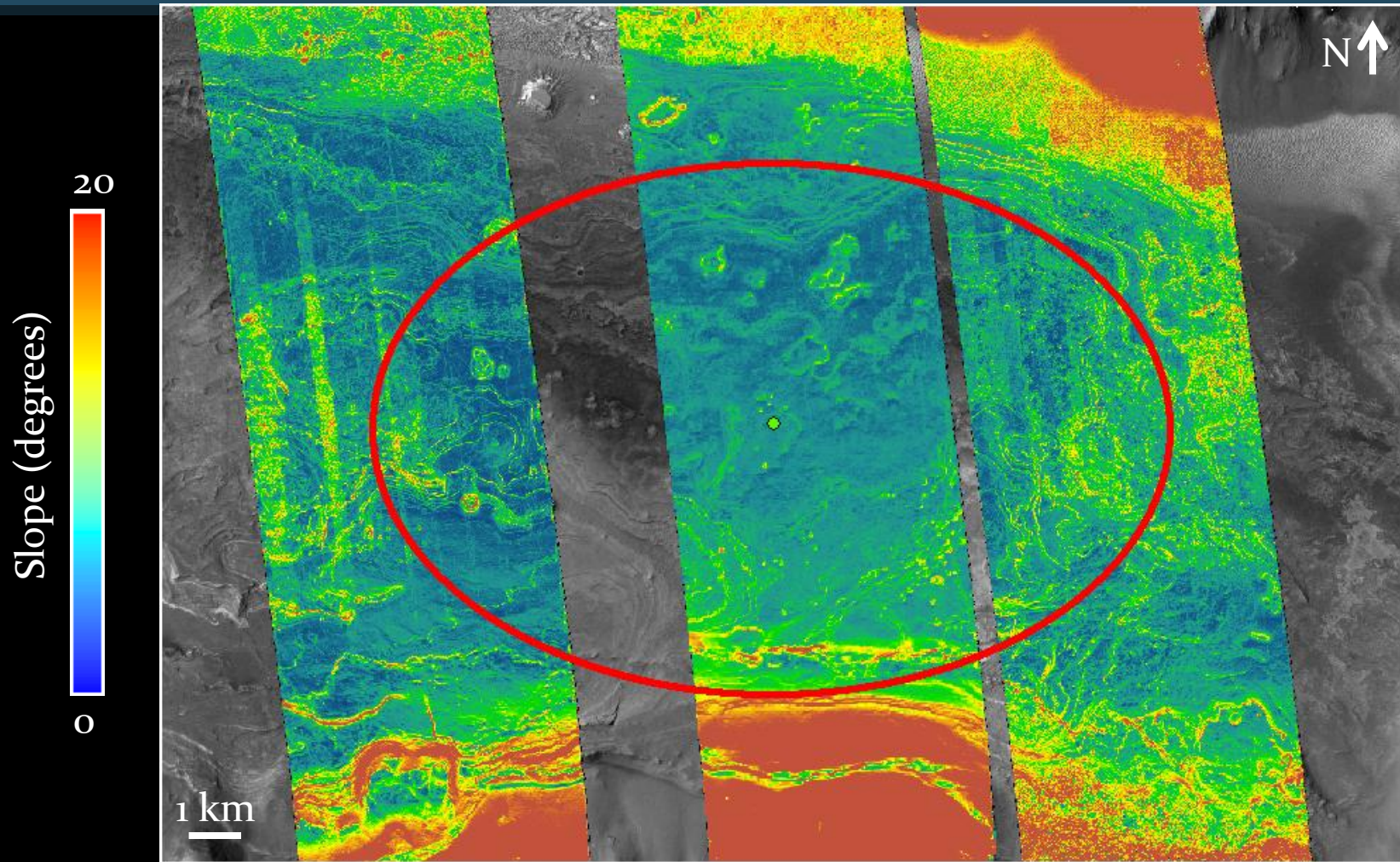
Assessment: few locales with relief in excess of desired range.



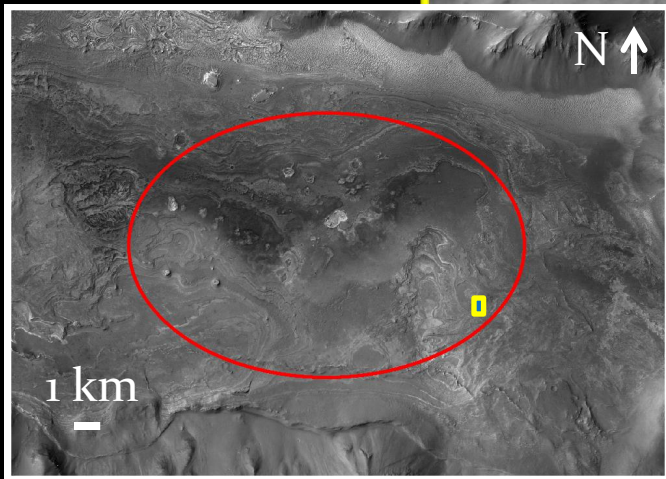
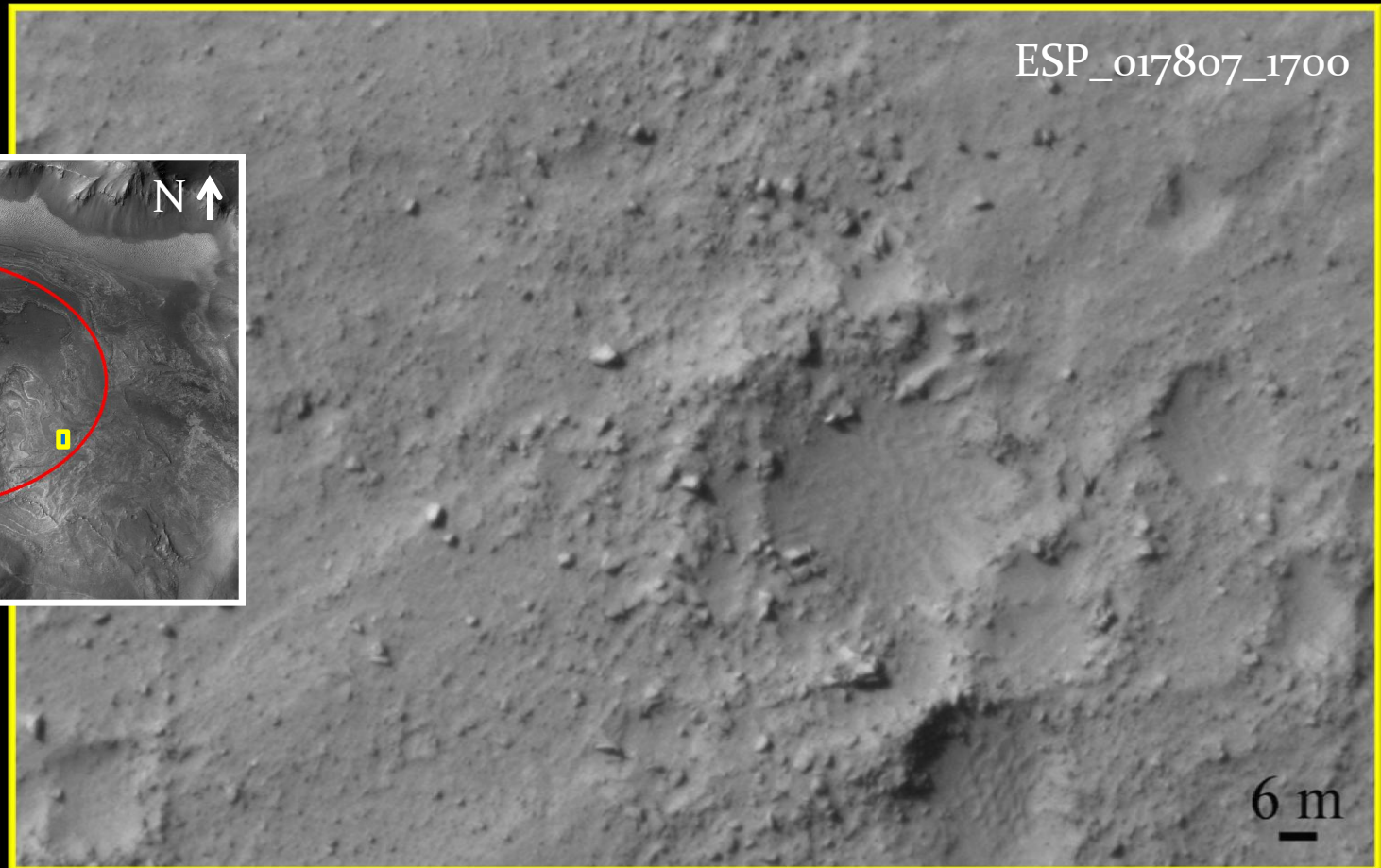
Slope Criteria: $<25^\circ$ over 2-5 m

Slope Maps derived from HiRISE DTMs

Assessment: Navigable paths exist, but not all science targets may be accessible.



Boulders Within Landing Ellipse

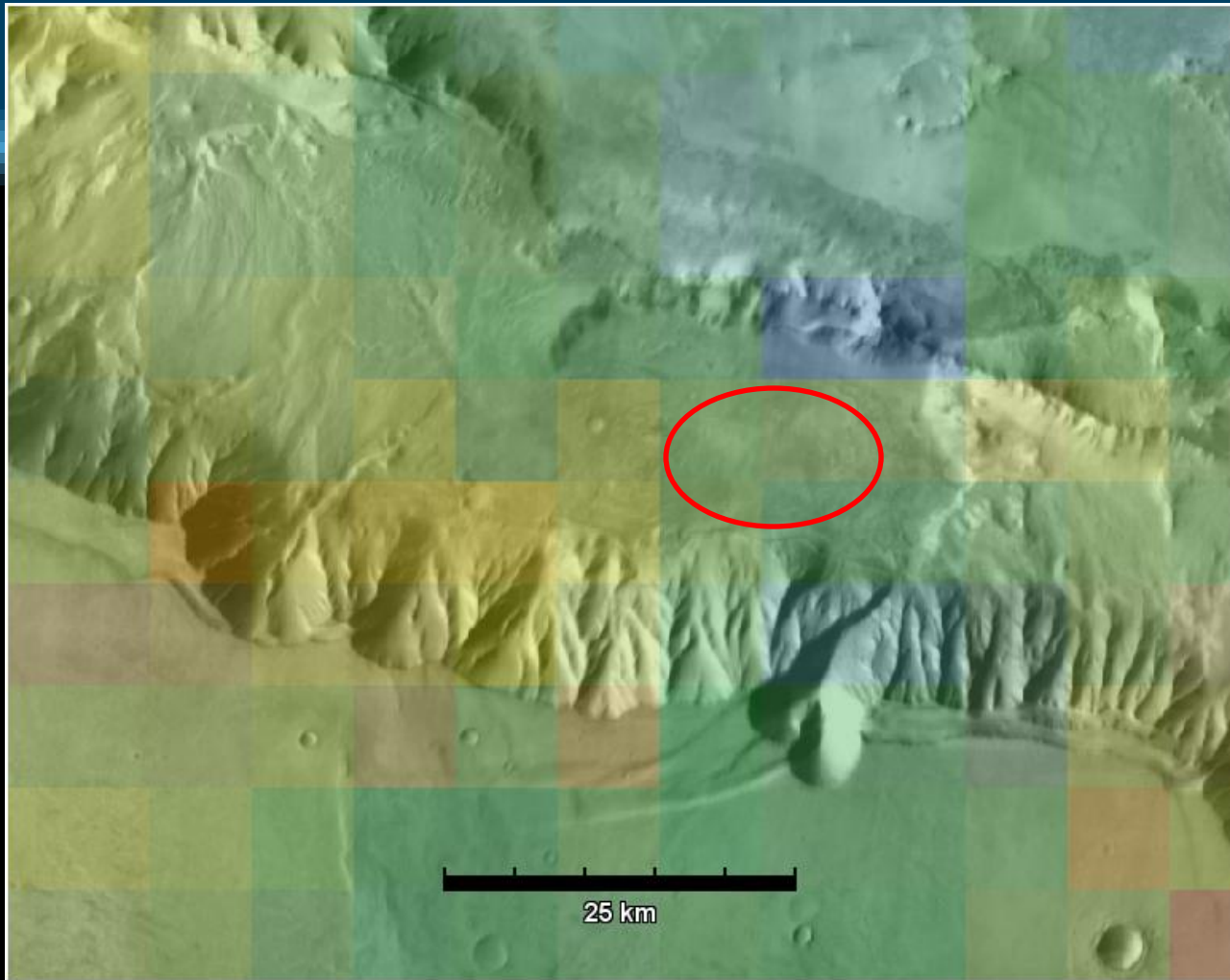


Summary

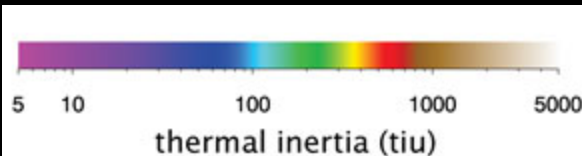
- Excellent image and spectral dataset for further assessment of landing site
 - Additional HiRISE stereo coverage would be useful.
- Preliminary analysis demonstrates that most engineering constraints are met.
 - Detailed route planning needed to ensure rover trafficability over layered terrain.
- Ground-based observations will constrain timing and duration of aqueous history.
 - Ellipse is located on primary target of interest (layered materials)
- Geologic diversity of site enables exploration of a number of scientific questions
 - application to understand similar landforms elsewhere on Mars.
 - How did light-toned layered unit formed?
 - What caused blocky deposits?
 - What is wallrock?
- Spectacular views from a descent imager inside Valles Marineris.

Supplemental Slides

Daytime Thermal Inertia

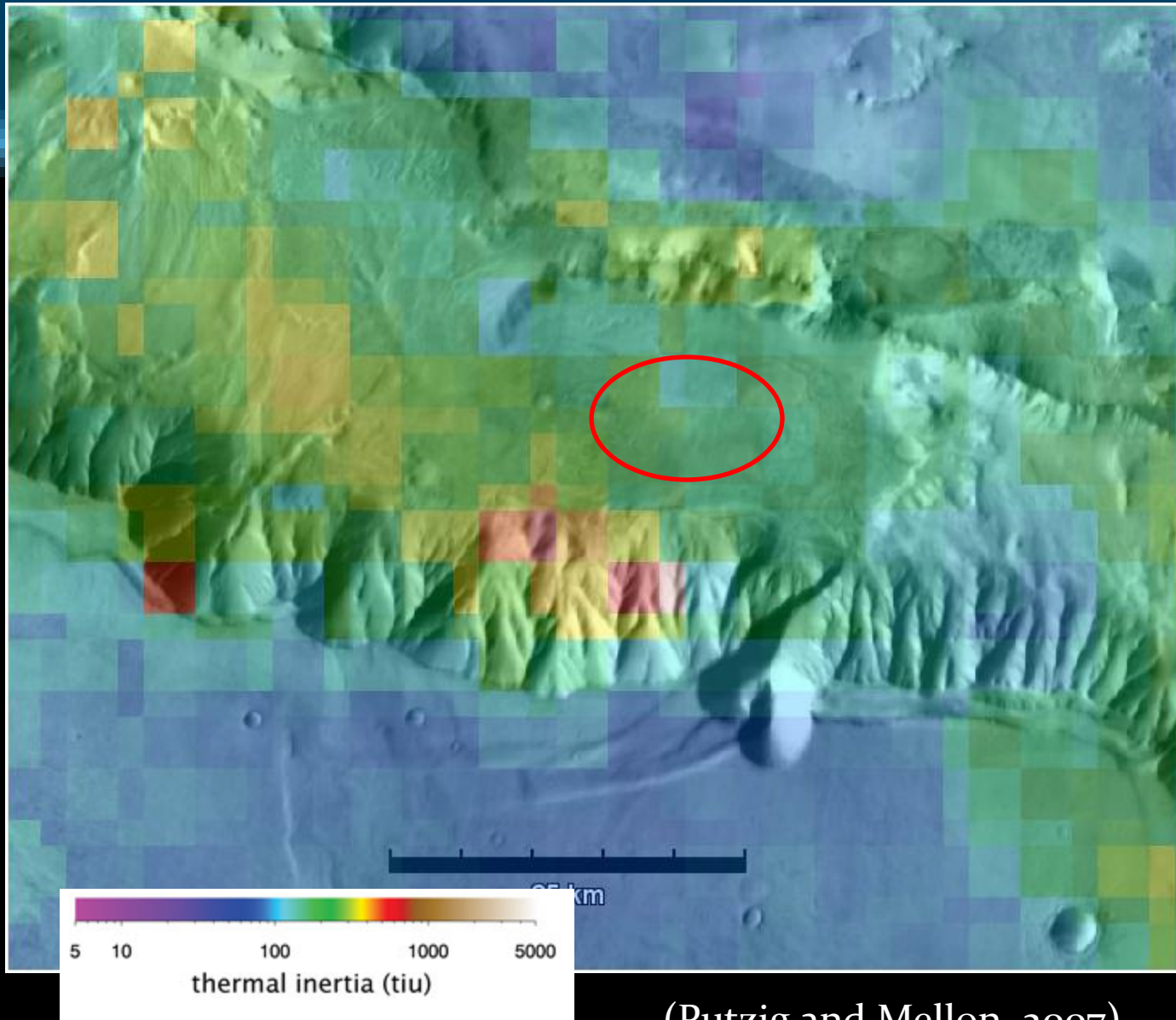


Meets criteria.



(Putzig and Mellon, 2007)

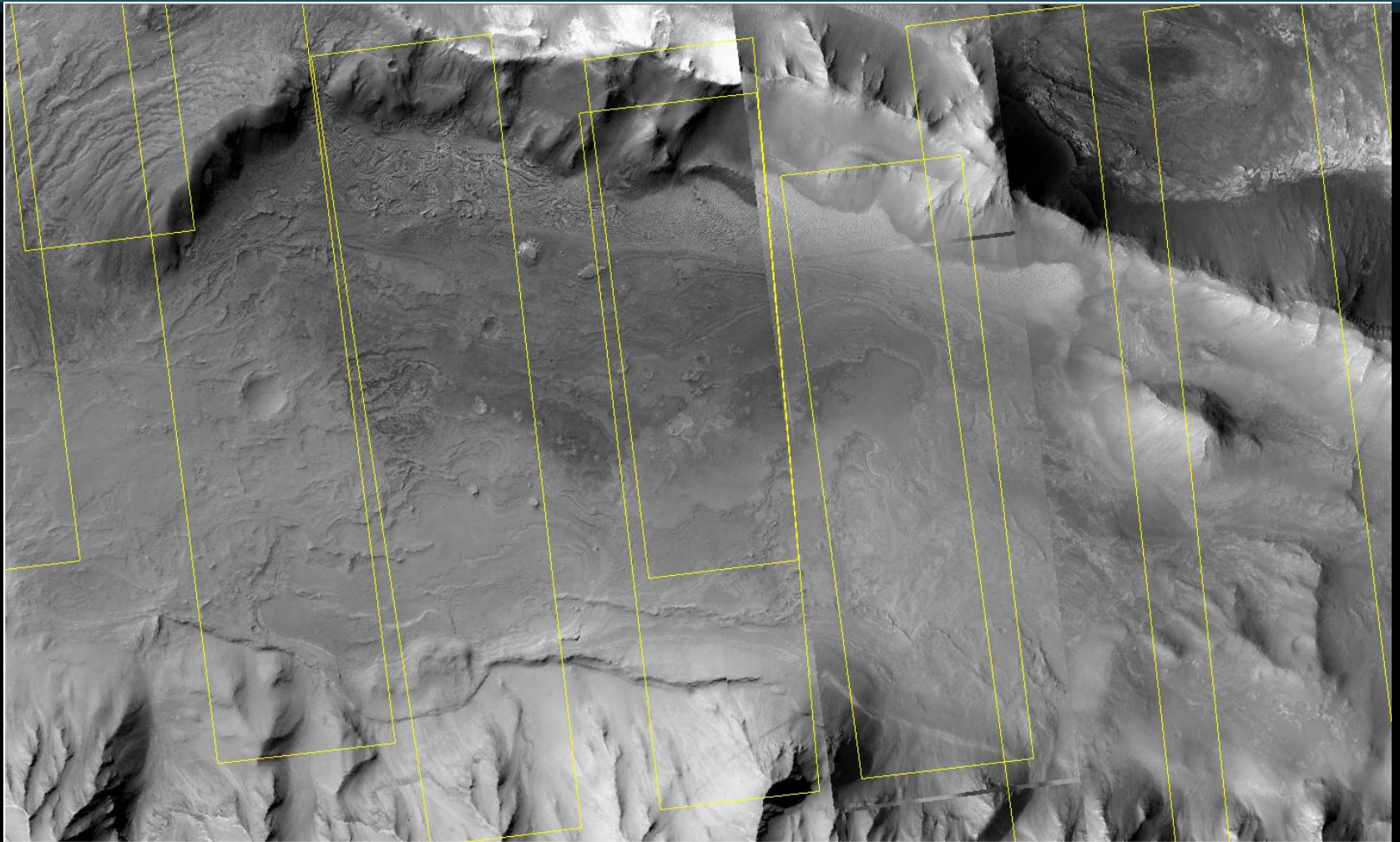
Nighttime Thermal Inertia



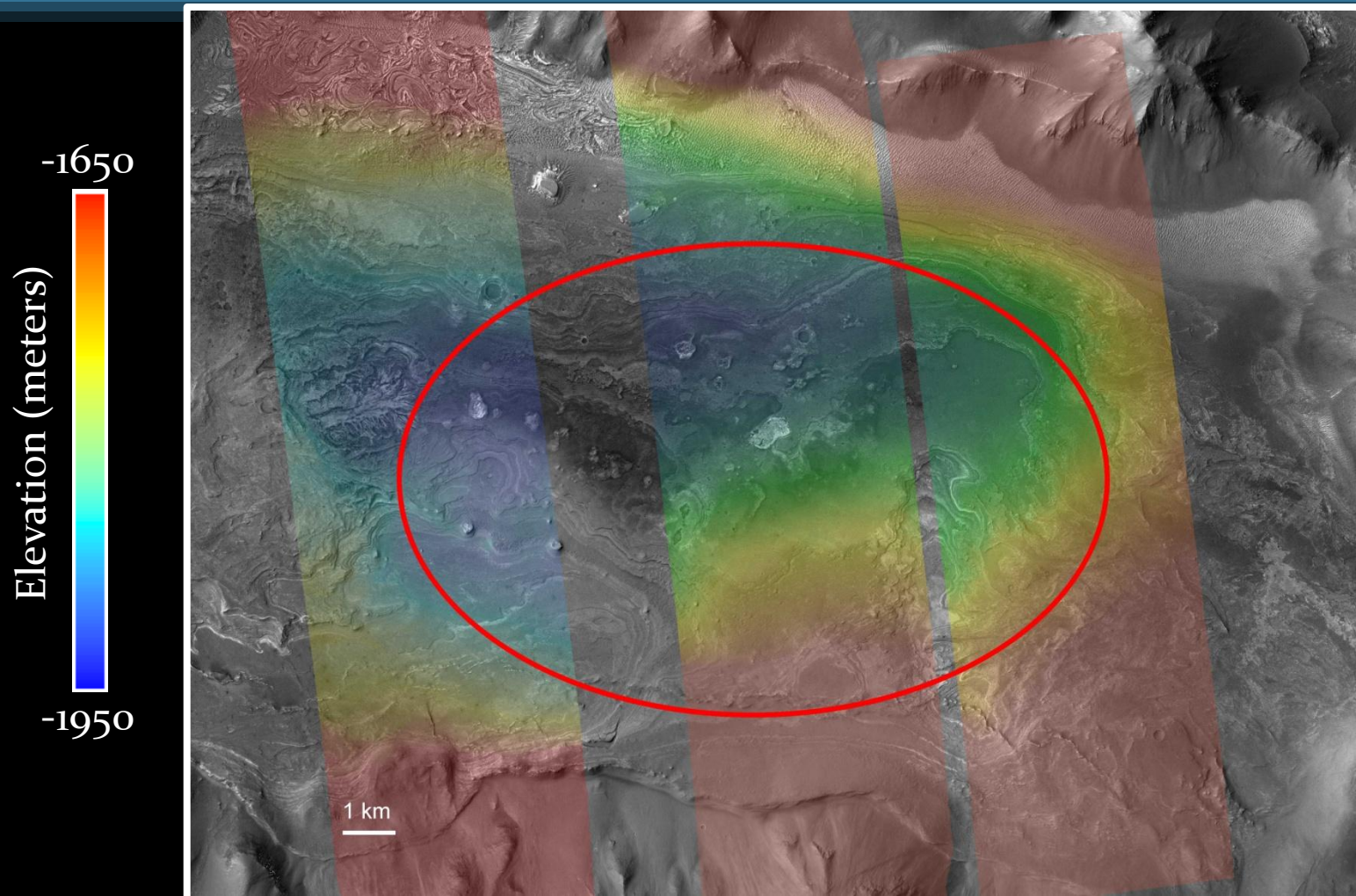
Meets criteria.

(Putzig and Mellon, 2007)

HiRISE Stereo-pair coverage

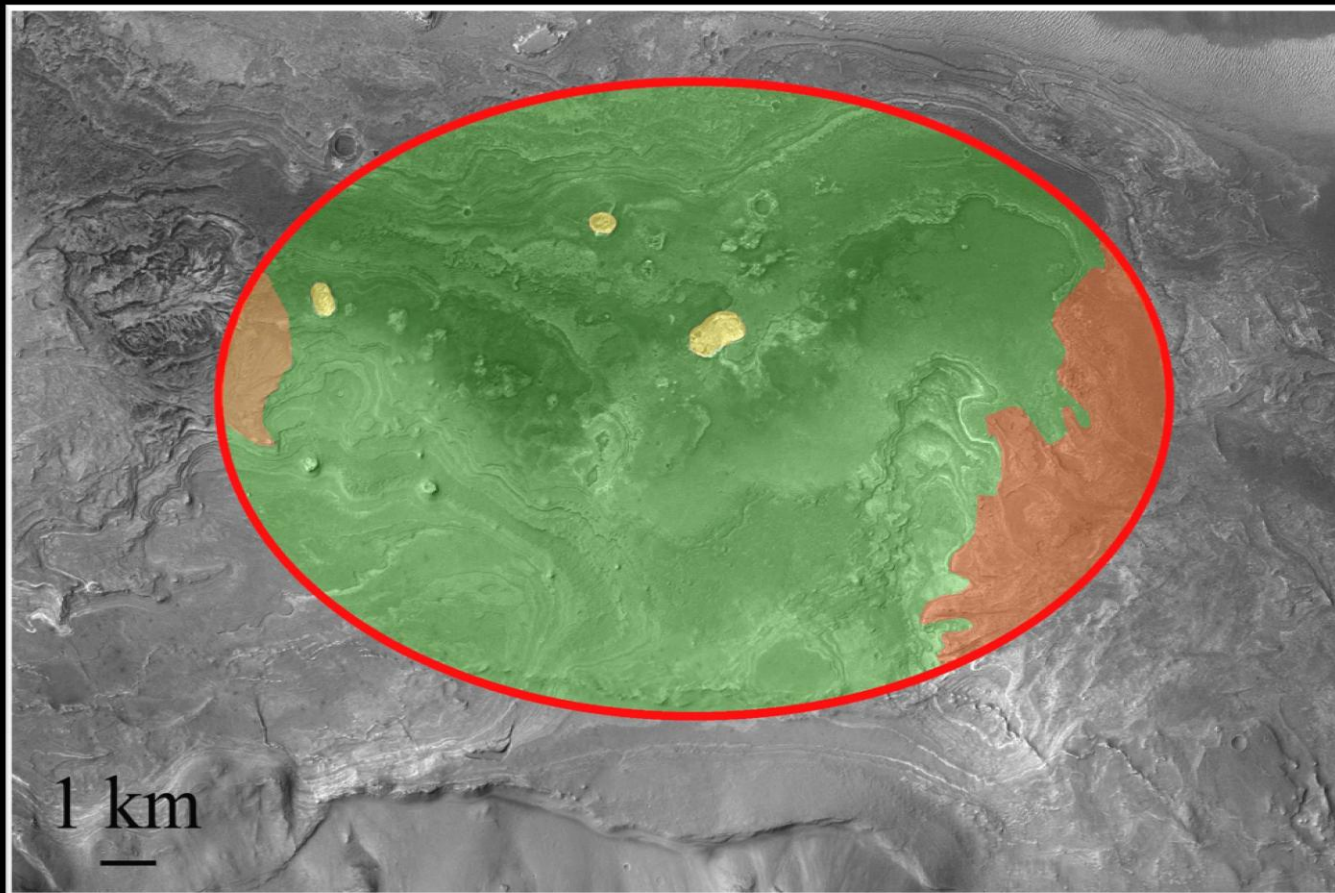





HiRISE DEMs



HiRISE
DEMs by
Dan Berman

Geomorphic Map



-  Layered Materials
-  Hydrated Silica
-  Fans